



Retina model mapped to the 25k processor Q-Eye chip

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Approaching object identification in retinal level

Retina model

Response analysis

Focal-plane sensor-processor array

25k mixed signal processors SIMD Local memory <200mW Operators:
addition, scaling, shifting, binary morphology, diffusion, averaging, optical sensing.

Eye-RIS vision system

AnaFocus, Seville

Implementation on SIMD processor array

Image capturing (P_n)

Inhibitory channels: Pixel level temporal convolution, $I_n = \sum_{l=0}^{k-1} i_k p_{n-k}$, 16 μs

Excitatory channels: Pixel level temporal convolution, $E_n = \sum_{l=0}^{k-1} e_k p_{n-k}$, 16 μs

Rectification: 4 μs

Subtraction: 4 μs

Spatial averaging: 50 μs

Rectification: 4 μs

Total: 98 μs

Computational examples

firing cells: Image of a bird in flight.

approaching object: Graph of response vs distance for approaching objects at 10 cm/sec speed. Curves are labeled R=15, 20, 25, 30.

lateral movement: Graph of response vs distance for lateral movement at 25 fps - 10 cm/s speed. Curves show distance increase (blue), distance decrease (red), and sum (green).

Additional details: T. A Münch, R. Azeredo da Silveira, S. Siegert, T. J. Viney, G. B Awatramani & B. Roska "Approach sensitivity in the retina processed by a multifunctional neural circuit", Nature Neuroscience, Published online: 06 September 2009

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